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Measuring Variability in Forage Fish Abundance

Introduction

The abundance, distribution and health of marine predator populations depends on the availability of suitable prey. The term "forage fish" is used to describe a variety of prey species that are commonly eaten, and share characteristics such as small size, high local abundance and high energy content. Declines in seabird and marine mammal populations in the Gulf of Alaska have been linked to shifts in abundance and composition of forage fish stocks over the past 45 years. Measuring variability in forage fish abundance is difficult, however, owing to their small size and patchy distribution.

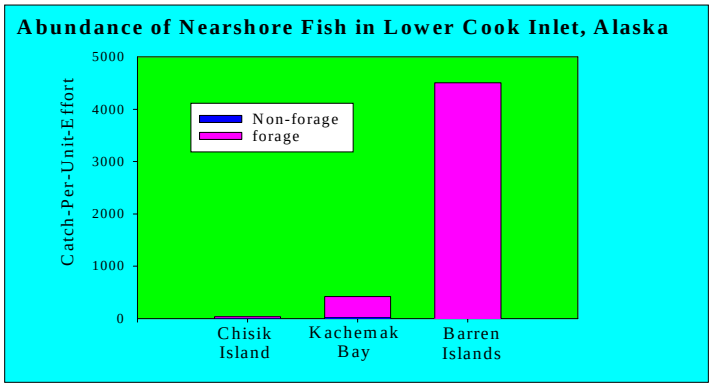
Inshore marine areas in the Gulf of Alaska provide essential habitat for several resident forage fish species such as sand lance and pricklebacks. Inshore habitat also provides nursery grounds for many marine fish species, several of which are important forage fish in their juvenile stages (e.g., cod, pollock and herring).

Beach seining is a cost-effective and practical method for sampling nearshore fish communities. As little as two people with a net and rowboat can seine in marine environments, although a skiff with outboard are more practical if larger areas are going to be surveyed. We use beach seines to study nearshore fish in Alaska.

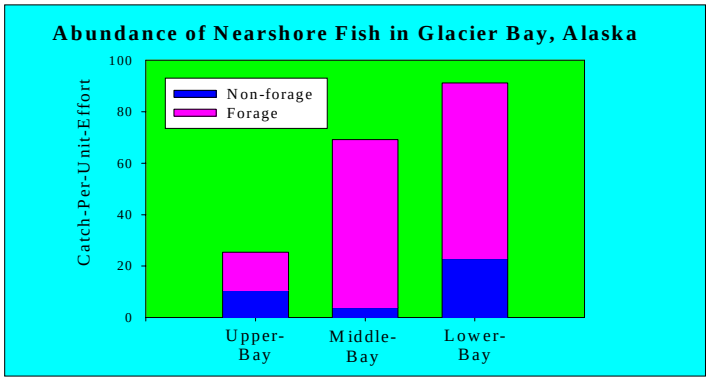
Beach seine catches provide an index of marine productivity (catch-per-unit effort or CPUE), community diversity (species composition) and characteristics of local fish (age, body condition, energy content). In turn, these data are useful for assessing the availability and quality of prey for local predators such as seabirds and marine mammals.

Case Studies

We sampled nearshore fish at multiple sites near three seabird colonies in lower Cook Inlet, Alaska. Sites were sampled repeatedly within and between years (1995-1999). Catches comprised mostly "forage fish" (see figure below) and variability in CPUE among study areas was consistent with that observed in concurrent trawl and hydroacoustic surveys. High productivity near the Barrens results from the intrusion of cold, upwelled water at the entrance to Cook Inlet. Seabird productivity at the three colonies was correlated with seine catches:



Chisik kittiwakes fail to produce chicks every year, whereas those at Kachemak and the Barrens are thriving. Forage fish abundance also varied within Glacier Bay, Alaska (see figure below). Mixed, cold oceanic water entering the lower bay supports larger fish popula-



tions than waters in the glacially-influenced upper bay. Compared to Cook Inlet sites (note CPUE scales), Glacier Bay was only as productive as waters around Chisik, a feature also reflected by the relatively small marine bird and mammal populations in Glacier Bay. For more information, search our web site at www.absc.usgs.gov/research/seabird&foragefish/index.html